

the linear variation in diameter from 1-inch (25 millimeters) at 35,000 feet (10,500 meters) to ¼-inch (6 millimeters) at 60,000 feet (18,000 meters) using the diameter corresponding to the lowest expected supersonic cruise altitude. Alternatively, three larger hailstones may be ingested at subsonic velocities such that the kinetic energy of these larger hailstones is equivalent to the applicable supersonic ingestion conditions.

(d) For an engine that incorporates or requires the use of a protection device, demonstration of the rain and hail ingestion capabilities of the engine, as required in paragraphs (a), (b), and (c) of this section, may be waived wholly or in part by the Administrator if the applicant shows that:

- (1) The subject rain and hail constituents are of a size that will not pass through the protection device;
- (2) The protection device will withstand the impact of the subject rain and hail constituents; and
- (3) The subject of rain and hail constituents, stopped by the protection device, will not obstruct the flow of induction air into the engine, resulting in damage, power or thrust loss, or other adverse engine anomalies in excess of what would be accepted in paragraphs (a), (b), and (c) of this section.

[Doc. No. 28652, 63 FR 14799, Mar. 26, 1998]

§ 33.79 Fuel burning thrust augmentor.

Each fuel burning thrust augmentor, including the nozzle, must—

- (a) Provide cutoff of the fuel burning thrust augmentor;
- (b) Permit on-off cycling;
- (c) Be controllable within the intended range of operation;
- (d) Upon a failure or malfunction of augmentor combustion, not cause the engine to lose thrust other than that provided by the augmentor; and
- (e) Have controls that function compatibly with the other engine controls and automatically shut off augmentor fuel flow if the engine rotor speed drops below the minimum rotational speed at which the augmentor is intended to function.

[Amdt. 33-6, 39 FR 35468, Oct. 1, 1974]

Subpart F—Block Tests; Turbine Aircraft Engines

§ 33.81 Applicability.

This subpart prescribes the block tests and inspections for turbine engines.

[Doc. No. 3025, 29 FR 7453, June 10, 1964, as amended by Amdt. 33-6, 39 FR 35468, Oct. 1, 1974]

§ 33.82 General.

Before each endurance test required by this subpart, the adjustment setting and functioning characteristic of each component having an adjustment setting and a functioning characteristic that can be established independent of installation on the engine must be established and recorded.

[Amdt. 36-6, 39 FR 35468, Oct. 1, 1974]

§ 33.83 Vibration test.

(a) Each engine must undergo vibration surveys to establish that the vibration characteristics of those components that may be subject to mechanically or aerodynamically induced vibratory excitations are acceptable throughout the declared flight envelope. The engine surveys shall be based upon an appropriate combination of experience, analysis, and component test and shall address, as a minimum, blades, vanes, rotor discs, spacers, and rotor shafts.

(b) The surveys shall cover the ranges of power or thrust, and both the physical and corrected rotational speeds for each rotor system, corresponding to operations throughout the range of ambient conditions in the declared flight envelope, from the minimum rotational speed up to 103 percent of the maximum physical and corrected rotational speed permitted for rating periods of two minutes or longer, and up to 100 percent of all other permitted physical and corrected rotational speeds, including those that are overspeeds. If there is any indication of a stress peak arising at the highest of those required physical or corrected rotational speeds, the surveys shall be extended sufficiently to reveal the maximum stress values present, except that the extension need